

Integrated Electrolysis & Sabatier System for Internal Reforming Regenerative Fuel Cells, Phase I

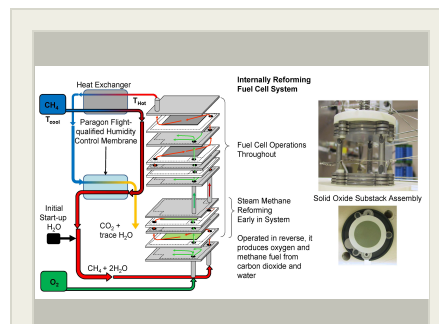
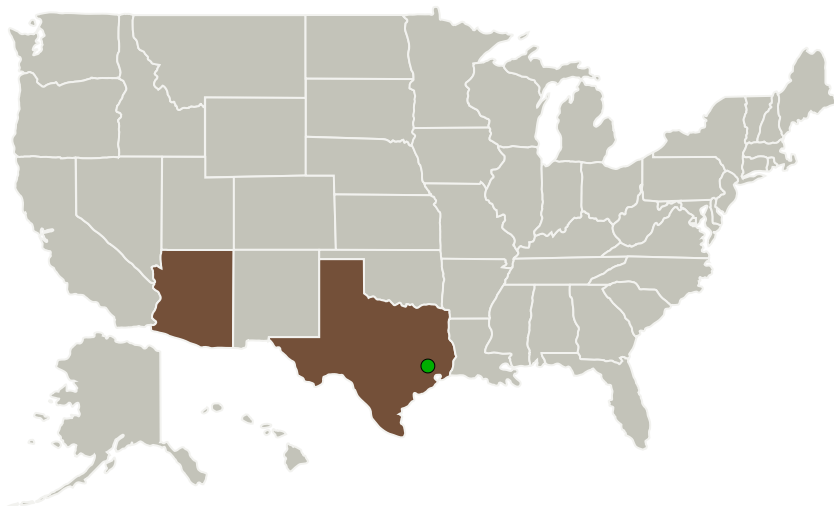
Completed Technology Project (2014 - 2014)



Project Introduction

Paragon Space Development Corporation® (Paragon) will advance our Solid Oxide Electrolysis / embedded Sabatier reactors (SOE/ESR) system to generate power from its oxygen (O₂) and methane (CH₄) products. Leveraging our SOE/ESR technology, Paragon can offer a carbon deposition resistant system capable of internally steam reforming CH₄ and generating power in fuel cell mode. Minimal water is required at start up; operations are sustained by recycling water from the affluent using Paragon's spaceflight-qualified humidity control membrane technology. The system is gravity-independent and compact with no moving parts and a high single-pass utilization of feedstock. Leak-tight operations are improved by employing a new 3D glass seal approach. The system will tolerate 100s of thermal cycles in high differential pressure environments. Our Phase I effort includes laboratory tests to determine the feasibility of employing new sealing features at high differential pressure and multiple thermal cycles. Tests will also confirm simultaneous internal CH₄ reforming and fuel cell operation without carbon deposition. The SOE/ESR Internally Reforming SOFC integrates cells that operate as either an electrolyzer / Sabatier reactor or a fuel cell. This simplifies operations, lowers hardware complexity, and increases reliability. The proposed system can perform multiple functions without modifications, making it a readily deployable technology for various missions from ISRU on the Moon and Mars to regenerating 100% of a crew's oxygen in habitats and space crafts.

Primary U.S. Work Locations and Key Partners



Integrated Electrolysis & Sabatier System for Internal Reforming Regenerative Fuel Cells Project Image

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Organizations Performing Work	Role	Type	Location
Paragon Space Development Corporation	Lead Organization	Industry	Tucson, Arizona
● Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations

Arizona	Texas
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Project Transitions

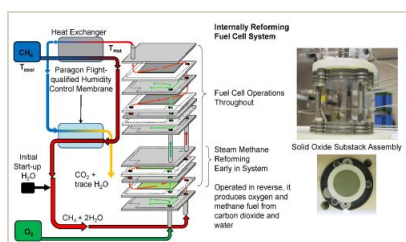
▶ **June 2014:** Project Start

✓ **December 2014:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137521>)

Images



Project Image

Integrated Electrolysis & Sabatier System for Internal Reforming Regenerative Fuel Cells Project Image

(<https://techport.nasa.gov/image/136404>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Paragon Space Development Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

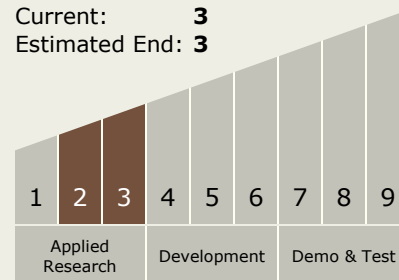
Carlos Torrez

Principal Investigator:

Christine Iacomini

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.2 Energy Storage
 - └ TX03.2.2 Electrochemical: Fuel Cells

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System